

**National Science Foundation (NSF)
Directorate for Computer and Information Science and Engineering
(CISE)**

**CISE Management Response to the
Information and Intelligent Systems Division
Committee of Visitors (COV) Report
December 12-14, 2005**

1. Introduction

The Information and Intelligent Systems (IIS) Division in the National Science Foundation (NSF) Directorate for Computer and Information Science & Engineering (CISE) held its Committee of Visitors (COV) meeting from December 12 to 14, 2005. The COV covered the period from FY 2003 through FY 2005.

The COV examined nearly 150 projects with associated merit review materials, dozens of two-page Computer Science area (or sub-field) reports aimed at future directions and innovations, three IIS annual reports, hundreds of research highlights, the previous 2003 IIS COV report, and many more reports of IIS-funded workshops and meetings as well as content from presentations made by IIS Program Directors. The COV also analyzed various collections of quantitative data to assess trends in funding, especially with an eye toward assessing how well CISE/IIS is supporting the current and next generation of researchers and educators.

CISE management expresses its gratitude to the members of the IIS COV and the Chair for their commitment and willingness to serve NSF and CISE and for the incredible energy and enthusiasm they brought to this activity.

The report of the COV, which is generally quite complimentary about IIS operations and outcomes, presents a series of observations, evaluations, and recommendations. In the sections below, we present the major recommendations and respond to them in detail. There are four major recommendations for the IIS division: 1) continue to encourage new PIs; 2) encourage broader participation; 3) fund high-risk, high-payoff research; and 4) fund multi-disciplinary research.

2. Recommendation One: IIS should continue to encourage young investigators to enter its fields of research and education.

The IIS COV found that the growth in the number of new PIs applying to IIS was higher than in the other CISE divisions. In particular, the number of unique PIs doubled from 2002 to 2004 from 933 to 1838.

With all the changes being made in the last couple years, we advocate that these statistics about new PIs be watched across CISE, as they relate to opportunities for growing diversity and for understanding how to allocate future CISE funds to match future needs. (IIS COV)

IIS thanks the COV for its data analysis on various issues like the number of new and unique PIs that applied to the division during the period covered by the COV. The division will update these numbers each year.

The IIS COV also encouraged the division to explore new ways of supporting and encouraging new Principal Investigators (PIs) to enter its fields of research and education. All IIS Program Directors (PDs) recognize the importance of recruiting and mentoring new investigators. As a consequence, PDs recruit panelists with a mix of experience and backgrounds. Having senior researchers on a panel helps those who are more junior to benefit from the panel experience. IIS PDs will continue to invest in PI meetings and other programmatic workshops, which provide additional opportunities for new or young investigators to interact with more senior scientists and educators in related areas of research.

Another approach is to develop individual “success stories” to post on the web. As a response to this COV, the CISE Office of the Assistant Director (OAD) will work with the Office of Legislative and Public Affairs (OLPA) to develop stories about real computer scientists and educators carrying out their research and education activities, including PIs from IIS. This approach has proven useful in the past. For example, the website for the Knowledge and Distributed Intelligence (KDI) program was designed in such a way as to highlight the people who received awards and their backgrounds as well as to highlight their discoveries. In that case, professional writers were hired to formulate stories about the KDI PIs. In this case, CISE will work with staff from OLPA.

3. Recommendation Two: IIS should continue to invent new ways of encouraging broader participation.

The participation of women is outstanding....The committee notes, however, that the acceptance rate of proposals sent by other minorities is rather low....This, on top of the already low rates of acceptance, can be discouraging for this group of underrepresented PIs, and can have negative influence on society in the long run, given the continuous increase in minority populations. We'd like to see some programming put in place that will help those who are at institutions where it is hard to get research mentoring have access to mentors who can help them grow their research and proposal-writing skills. (IIS COV)

CISE understands that outreach is an important activity for all its Program Directors. Starting in 2003, the annual performance plans for all Program Directors included outreach as an essential element of their jobs. Each year, IIS is well represented in the Foundation's outreach activities (through OLPA, Experimental Program to Stimulate

Competitive Research [EPSCoR], and the Policy Office) where proposal-writing skills constitute a significant part of the outreach program.

As a directorate, CISE has taken a number of steps to encourage diversity in all aspects of its programmatic activities. The 2002 reorganization designated a “cluster” of programs labeled “Education and Workforce” to be the directorate home for programs focused on outreach to underrepresented groups in computing. This cluster actively recruits Program Directors that care about and interact well with underrepresented groups and act as role models across the directorate.

One program in this cluster, Broadening Participation in Computing, has been very successful in setting up alliances of academic partners, non-governmental organizations, and local governments to work on various approaches to building diverse communities of computer science students, faculty and professionals across all areas of CISE, including IIS. This program is now in its third year.

As a division, IIS is also well represented in the EPSCoR program, which helps leverage NSF-wide program funds with additional monies for research projects in the twenty-five states (and Puerto Rico and the US Virgin Islands) that receive lesser amounts of Federal funding. An IIS PD is the CISE representative to the EPSCoR program. In that role, he must educate the directorate about EPSCoR and help all CISE PDs to work with this program. Because he has been so successful, all PDs have become very aware of how important and helpful this program can be. IIS has been very successful in getting funding for EPSCoR projects. We expect this to continue.

One of IIS’s Program Directors serves as a role model for outreach. She likes to include an extra day or half day in her official travel for outreach activities. So, for example, when she is in New Mexico, she can visit one of the Tribal Colleges or when in Northern California, she can talk to faculty at four-year colleges. She is presenting her “best practices” in division and directorate meetings, which encourages others to embed more outreach into their own routine travel and everyday activities.

IIS is aware that it has a special role to play in encouraging diversity due to the research that it funds. The COV found that higher percentages of women submit to IIS than to any other division in CISE. One hypothesis -- based on the literature on gender issues in computer science -- is that women (and other underrepresented groups) are more attracted to computer science research and education when societal benefits are clear and when usability and/or design play a central role, which is often the case in IIS research and education.

Keeping this in mind, the division is exploring ways to be thoughtful and creative about how it writes solicitations, hires new program directors, and interacts with its external constituencies so as to insure that women and underrepresented groups can continue to find a natural home in IIS. For example, the IT and Creativity Program currently being developed by a PD in IIS is the kind of new program that should prove equally attractive to women and underrepresented minorities as to others.

4. Recommendation Three: IIS should fund high-risk, high-payoff research.

Extreme competition for resources can work against risk-taking and innovation. We saw brilliant, innovative, high-risk proposals that seemed extremely promising, but which were ultimately unfunded. We advocate that IIS panels and reviewers explicitly address proposals on innovation/risk criteria in order to check the natural tendency towards caution when resources are less plentiful. (IIS COV)

IIS is committed to funding transformative, high-risk, high-payoff research. Across the Foundation, there is recognition that achieving this goal is important. Simultaneously, everyone recognizes that it is a challenge. Panelists often want more guidance and clarity (e.g., definitions) on what is meant by these terms.

The National Science Board (NSB) recently provided a definition in its draft report (NSB-07-6), *Enhancing Support of Transformative Research at the National Science Foundation*. It is:

Transformative research is defined as research driven by ideas that stand a reasonable chance of radically changing our understanding of an important existing scientific or engineering concept or leading to the creation of a new paradigm or field of science or engineering. Such research also is characterized by its challenge to current understanding or its pathway to new frontiers. (NSB)

IIS will present this definition (and/or any subsequent changes to it by the NSB) in the guidance it gives to reviewers and panelists.

We would encourage program officers to ensure that panelists understand that their role is to identify promising research rather than to seek reasons to reject proposals for funding. The merits of a proposal should be stressed at least as much as its shortcomings (despite computer scientists' natural tendency to focus on the latter). (IIS COV)

NSF could take steps to help ensure that reviews provide information that investigators can use effectively in revising and resubmitting proposals. Making exemplary reviews available to reviewers in advance of the review process might help to raise overall quality. Program managers might also encourage other panel members to comment upon the quality of reviews overall. (IIS COV)

Over the past year, across the Foundation and within CISE, committees have been constituted to investigate the merit review process, determine best practices, and make recommendations on how best to move forward. CISE's merit review committee recommended that reviewers need to be encouraged to write higher quality reviews and to make evaluations based on what is novel and ground-breaking, rather than simply finding fault with proposals – in a kind of process of elimination. IIS plans to institute, 1)

the use of several standard slides for all panels, which will encourage broad thinking and make recommendations for how panelists should think about transformative research, and 2) a panel summary template that encourages more expansive comments from the panelists. A special section has been added to the template asking about the extent of “transformative research” found in the proposal. The new definition of transformative research will be provided to panelists and reviewers.

We recommend that all panels be made aware of the possibilities for SGER (IIS COV)

Over the period of the COV, most programs in IIS invested in SGERs. In fact, the COV explicitly mentioned that the number of SGERs had gone up since the last IIS COV. It is the intent of IIS to encourage its PDs to use their SGER flexibility to the extent possible, including educating panelists about SGER opportunities for seed funding for novel and untested ideas and time critical discoveries.

But the funding of transformative or high-risk, high-payoff research is not just captured in the statistics about SGERs. In the summer of FY06, IIS carried out a set of experiments in an attempt to loosen the direct connections between panel and PD recommendations. Typically, panelists are told to put proposals into one of three categories – highly competitive (HC), competitive (C), and not competitive (NC). Typically, the PD funds the HCs, some of the Cs and none of the NCs. But surely, panels make mistakes due to strong personalities, failure to know that one is reinventing the wheel, misunderstandings about what is novel or what has already been tried and failed.

In its experiments, IIS asked one panel to not use any funding categories, and another panel to use two categories – Fund, if Possible and Do Not Fund. The major finding from these experiments is that the panelists liked using two categories, but not having any categories was difficult, and nearly impossible to execute. Across its clusters, IIS has instituted a two-category system. The intent is to have PDs exercise more autonomy in their decision-making about awards.

5. Recommendation Four: IIS should continue to excel in funding multi-disciplinary research. IIS should continue to encourage new areas of research (e.g., life-long learning, technologies in support of aging).

We applaud NSF’s support for multidisciplinary work, and note that IIS is particularly strong in this regard. At the same time, we would advocate that CISE consider both how to better define and how to measure such support. (IIS COV)

IIS has set up its new clusters with an eye to bringing related fields of science more closely together and, at the same time, encouraging new fields across clusters to emerge. For example, the most recent IIS solicitation calls out the emerging and highly interdisciplinary fields of human-robot (and agent) interaction and information privacy and security.

IIS will continue to encourage new and interdisciplinary areas of research. In FY07, IIS interdisciplinary investments include creativity and IT, human-robot interaction, information privacy and security, ethics education in science and engineering, science of design, human and social dynamics, confidential databases, digital government, human-centered computing, computational neuroscience and science informatics. By designating cross-cutting programs or emphasis areas (that cross clusters, divisions, directorates, etc.) as interdisciplinary, it will be easier to automatically track our interdisciplinary investments over the years and to monitor how well the projects do.

As IIS moves to cluster-based solicitations (perhaps increasing multidisciplinary proposals), assembling qualified panels can become more difficult unless care is taken. Ad hoc (mail) reviews may supplement panel reviews to add expertise in particular areas. Overall, IIS staff is aware of these issues; we recommend vigilance and close attention to the impact of these changes on the review process. (IIS COV)

IIS agrees that the effectiveness of the review panels is integral in assuring a quality merit review process. IIS PDs have gained significant skills over the past ten years in managing interdisciplinary panels. PDs were involved in the KDI program and then in the five-year ITR Priority Area. During this time (and since then), many new interdisciplinary programs have been developed by IIS PDs. In fact, IIS PDs tend to like interdisciplinary research topics and to want to work across clusters in pursuit of new areas of research as well as across CISE and NSF. New IIS PDs are often recruited because of their breadth and depth and their interest in these issues and challenges. IIS will need to insure that this important organizational knowledge that has accrued over the years be passed on to new program directors.

CISE is a directorate that primarily uses the panel review mechanism. IIS will work to insure that ad hoc reviews are used when there is insufficient subject matter expertise in the members of the review panels.